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ABSTRACT

To determine whether gifted children are faster than average students on all behaviors sampled or only on academic subjects, 46 gifted and 30 average children were tested. The time rates for tapping, walking, reading, answering, and calculating were determined. All children were from grades 4 through 6; median IQ of the gifted was 138, and for the average 110. The results were that some gifted rates were similar to the average performance, but generally the gifted performed significantly faster on both academic and non-academic behaviors. Also the higher the grade level the faster the behavior, and the correlations between academic rates and achievement scores, non-academic rates, and intelligence test scores are all beyond the .005 level of significance. The conclusion is that study should be made to determine whether accelerating behavior rates could increase abilities and giftedness. (JM)

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A MONOGRAPH FROM

THE NATIONAL ASSOCIATION FOR GIFTED CHILDREN

BEHAVIOR RATES OF GIFTED AND REGULAR ELEMENTARY SCHOOL CHILDREN

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University of Kansas

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Reporting Current
RESEARCH ON
GIFTED BOYS AND GIRLS
of Interest to
Educational Institutions

- PROGRAMS
- PRACTICES
- RESEARCH
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BEHAVIOR RATES OF GIFTED AND REGULAR ELEMENTARY SCHOOL CHILDREN

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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AN INTRODUCTION FROM THE EDITOR

We take pleasure in publishing this first monograph from The National Association for Gifted Children.

The topic is one which educators should have focused upon long ago, but instead has remained neglected. Were this done in an environmental climate of neutrality, this would be sufficient. Often when there has been attention to the rapid learner, it has not been from the point of view of how to aid the child in sustaining this attribute. Rather the opposite has been frequently exemplified in the treatment of this child, by would be well intentioned educators, from highly accredited schools.

Instead of viewing this child as one who has the potential of swiftly solving man's problems, and endeavoring to imbue him with such inspiration, he has at times been labeled a rebellious non-conformist.

It is a coincidence that simultaneous with the preparation of this manscript, a number of school systems came to our attention, each in their own way dealing with the gifted and the issue here, rate of performance. The school systems had in their own way arrived at solutions of "how to slow this child down". Both schools had ten year old boys interested in science, whose I. Q.s were above 150, with science achievement test scores at senior high school level.

In the one system, the boy was retarded a grade, rather than being permitted to proceed with his own age group. the fifth grade, which chronologically would be suggested. He was scheduled to repeat the fourth grade. The other boy who successfully completed standardized achievement tests which allotted forty minutes to a task, in ten minutes, had been accelerated to the sixth grade. But this did not provide the immediate answer to slowing him down either . . . He was still able to complete his assignments ahead of his classmates, to the consternation of the teacher, who handled the situation by daily sending him to the principal's office. It was at this point that the child came to our attention. Happily it can be reported that all whose lives touch both boys are stating the children have changed considerably in their work habits, and attitudes to the peer group, administration, as well as those at home.

The changes are attributed to insights which were presented to both children and school authorities, resulting in a new look at the gifted, and how this can result in service to the school, and improved feelings of self-worth for the individual, manifesting itself in more constructive behavior.

The first child needed some remediation, since his achievement scores were disparagingly broad, with some (the science achievement at 11th grade level, while the reading was recorded only at 1.9 level). Within three months this boy was reading three years above his grade placement of the fifth year, and still showing additional steady improvement.

Typically the gifted do not perceive themselves as members of this category, which leaves to chance that society will be the recipient of their gifts. Interestingly, those of us in authority, because we sometimes do not properly interpret their behavior, inadequately meet their needs, and in turn do little to bring about any increment in the child's positive self-concept. This has been demonstrated to have a relationship to underachievement.

The world needs all of its gifted people. Each of us can become more alert to discovering ways that will make it possible for them to give us their gifts.

This study provides provocative insights which can result in new perspectives on maximizing talents. It points the way we need to go. We are much convinced it is our duty to produce opportunities which are productive. This monograph can have immediate use and application by the classroom teacher.

We are honored to have the opportunity to present this very important paper.

Ann F. Isaacs, Executive Director
THE NATIONAL ASSOCIATION FOR GIFTED CHILDREN

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ABSTRACT

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Tapping, walking, reading, answering, and calculating rates of 46 gifted and 30 regular children were sampled, and performances of the same pupils on an achievement test reported. Although some children with intelligence-test scores of 130 or above performed at similar rates to those of regular children, the gifted as a group performed significantly faster than did the regular pupils. Also discussed: rate indications of grade differences and implications of the higher performance rates of gifted children.

1. This study was supported in part by the United States Office of Education (Public Law 88-164), the National Institute of Neurological Diseases and Blindness (NB-05362-05), and the National Institute of Child Health and Human Development (HD-00870-05) to the Bureau of Child Research, University of Kansas.

2. Gratitude is expressed to Dr. Ogden R. Lindsley, major advisor and mentor, for his expert guidance and brilliant, courageous, productive work. The author is also indebted to the administration and faculty of Antioch School and of Pembroke-Country Day School for their generous cooperation. To the pupils, especially, goes a special note of thanks, for without their abundant behavior this study would not have been possible.

3. This study was submitted to the Department of Education, and to the Faculty of the Graduate School, of the University of Kansas in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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INTRODUCTION

David opened his book, read for three minutes, and closed it again. He asked the teacher, "What should I do now? I'm finished with my reading assignment."

We all have had children in our classes who did things faster than other children. By some definitions (Terman and Oden, 1947; DeHaan and Havighurst, 1961; Gallagher, 1964; Hildreth, 1966), these are the gifted ones - the special ones each of us feels fortunate to have in class. Sometimes, though, we are at a loss for the most effective method of handling all that energy and intellectual prowess.

What defines a gifted child? How does he look, act, work? Which things does he do faster? What makes him stand out from the other children in the class?

How can we answer such questions more precisely?

Education has been concerned with these issues since the late twenties and thirties, when Terman (1925) and Hollingworth (1926) published their monumental works. The sixties find us concerned with similar questions. Fortunately, measuring techniques not fully developed nor utilized in the past can contribute potential answers.

The shift from indirect to direct measurement signifies a change from reliance on intelligence-test scores, or achievement-test scores, to direct rate records of the number of problems correctly completed per minute. Rate records markedly increase the precision of information. The shift from group to individual measurement therefore increases the number of precise statements which can be made about each child.

Children differ in many ways. One yardstick to use, in examining these differences, is rate. The number of instances of a given behavior over a time span defines rate. A behavior sample could determine whether a gifted child performs faster than a regular child. The immediacy, directness, and precision of this rate sample, plus continuous rate records, provide current information on which to base curriculum planning and classroom organization. Using them, the teacher can immediately observe the difficulty level of a series of problems for a particular child. This allows her to make immediate changes in her programming—a benefit which a test given every six weeks does not include. Rate records can also detect changes in the child's home life (Koenig, 1967), in his personal behavior problems (Duncan, 1967), and in the classroom situation (Johnson, 1967a).

Education faces the problem of measurement every school day. The problem becomes maximized when teaching gifted children, because of their rapid progress through curricular material and current as well as future potential contributions. Teachers need more information. Rate supplies important information to the child (Holzschuh and Dobbs, 1967), teachers (Haughton, 1967b), parents (Lindsley, 1966a), administrators (Edwards, 1967; Haughton, 1967a), and precision-teacher trainers (Caldwell, 1967). A gifted child in a stimulating academic and home environment with programmed contingencies and consequences may work five times faster than before, thereby covering more material in less time, and possibly completing more problems correctly per minute.

If gifted children do behave at faster rates than average children, the implications are indeed widespread. For example, David reads non-fiction history books at 750 words per minute - while Joe reads at only 250 words per minute. David has the opportunity to acquire three times as much information as Joe. Specifically, in one hour David could have read 45,000 words, while Joe would have read 15,000. In one school year, given equal time spent in reading, David has access to more than eight million words, whereas Joe has access to only two million. In 12 school years, the difference increases to 97 million words for David and 32 million for Joe. Since gifted children read more daily outside of school work (Cappa and Schubert, 1962), the differences over a lifetime could be in the trillions. This fantastically increased opportunity to learn, produced by higher performance rates, could alone account for the gifted child's superior accomplishments (Lindsley, 1967).

PURPOSE

Behaviors ranging from tapping to calculating were sampled from individual children. The purpose was to determine if gifted are faster than regular pupils across all behaviors sampled, or faster only on academic subjects.

RELATED RESEARCH

GIFTED CHILDREN

The amount of descriptive information about gifted children is overwhelming. There exist at least five cogent summaries, reviews, and bibliographies which have been published since 1960 (Holt, 1960; Anderson, 1961; French, 1964; Gowan, 1965; Gallagher, 1966). Gallagher lists 253 books and articles, 66 percent of which have been published since 1960. Noting the increasing volume of material on creativity, 50 percent of Gowan's (1965) references (N=1,222) deal with this topic. By way of contrast, Holt (1960) devotes only two percent of 847 references to creativity. Characteristics of the gifted (e. g., learning ability, test performance, and so forth), merit 22 percent of the references by Holt, whereas Gowan's references include only three percent. Thus, an analysis of these bibliographies reveals a dramatic shift of attention in studies of gifted children.

DEFINITION OF GIFTEDNESS

The following summary presents 10 alternative definitions of giftedness.

Witty (1940) defines a gifted child as one whose performance is consistently remarkable in any potentially valuable area.

A conference on the gifted at Teachers College, Columbia University, in 1940 suggested we may define the intellectually gifted child as one who excels markedly in ability to think, reason, judge, invent, or create (Hildreth, 1966).

Havighurst, Hersey, Meister, Cornog, and Terman (1958) maintain that the talented or gifted is one who shows consistently remarkable performance in any worthwhile line of endeavor.

Tannenbaum (1958) simply requires that any definition of talent must have a social reference.

Sumpton and Luecking (1960) define the gifted as those who possess a superior nervous system characterized by the potential to perform tasks requiring a comparatively high degree of intellectual abstraction or creative imagination.

DeHaan and Havighurst (1961) define gifted children as those individuals, from kindergarten through high school age, who show unusual promise in some socially useful area and whose talents might be stimulated.

Fliegler (1961) suggests that gifted children possess superior general intellectual potential and ability, a high functional ability to achieve academically, and a high order talent. According to Fliegler, this definition includes fifteen to twenty percent of the school population.

Taylor and Holland (1962) propose that the term *gifted* should always be preceded by an adverb such as intellectually or creatively gifted. They suggest that we define by our intelligence tests what we measure and mean by intelligence.

Gallagher (1964) reports the primary definition of giftedness as based on performance in school and school-associated tests. Giftedness as measured by intelligence tests results in the following incidences: Stanford-Binet IQ 148, 0.1 percent in the academic community; IQ 132, 2 percent; and IQ 116 (aca-

demically talented), 16 percent.

Hildreth (1966) describes as gifted those who are accelerated in all aspects of mental development, including reasoning ability, rapidity in learning, and precocious linguistic development. In addition, the gifted are those who have displayed outstanding academic achievement, special talents, and/or creativity. Hildreth supports Taylor's notion of using adverbs with the term *gifted* for more clear delineation.

To summarize: the definitions of giftedness just mentioned are characterized by future social judgments (40 percent), and by indirectly measured, non-functional descriptions (60 percent).

CRITERION OF INTELLIGENCE TEST SCORES

Various investigators use different intelligence-test scores as their criterion for inclusion in the sample of gifted children. The following is a brief synopsis of some studies and the intelligence score criterion utilized.

Intelligence Test Score	
110-115	Wall (1960)
120	Fliegler (1961)
	Klausmeier and Loughlin (1961)
125	Baldwin (1962)
130	Martinson and Lessinger (1960)
	Flescher (1963)
	Laycock and Caylor (1964)
132	Gallagher (1964)
136	Pegnato and Birch (1959)
140	Terman (1925)
148	Gallagher (1964) (high gifted)
150	Gallagher and Crowder (1957)
	Getzels and Jackson (1960) (the mean)
180	Hollingworth (1926)

To summarize: the criterion median of the sampled studies was an intelligence-test score of 131. This study used an intelligence-test score of 130 as the criterion for inclusion.

PERFORMANCE RATES OF GIFTED CHILDREN

In a survey of 15 books and reviews and over 100 articles, rate was used only once as a measure of performance of gifted children. The notion of a faster rate was cited as a characteristic of gifted children by several authors (Passow, 1958; Flanagan, 1962; Bish, 1963; Hildreth, 1966). An excellent example is from Gallagher (1964) when he states, "most descriptive terms to assist a teacher in identification imply or directly involve rate of learning." The difficulty has been the lack of rate *data*. In other words, some educators agree that a faster rate of behavior has importance; however, little concrete evidence supporting this has been presented.

Rate is the frequency of behavior over a time span (number divided by time). Klausmeier and Loughlin (1961) used a component of rate (time) without the other important component (frequency). They gave each child a different arithmetic problem at his pre-test level of performance. The children were gifted fifth-grade boys and girls (WISC IQ 120 and above); average (IQ 90-110) and slow (IQ 56-81) (N=40). They found that time spent in solving the problems was not significantly different

for any of the groups. Unfortunately, their study did not utilize the behavior of operations correct per minute, which assesses the level of complexity of the material and allows a valid, across child comparison (Johnson, 1967b).

Gold (1963) also used time as a measure of 365 gifted childrens' behavior on a task similar to Guilford's "uses of a brick." The children (IQ 120 and above) turned a page every five minutes for 45 minutes. Their scores on what they wrote were listed, one through nine. The control group had five minutes in which to complete the same assignment. He found that the more time the individual had, the more original his production. He criticized his own study by the failure to use rate and by stating that terminating the time too rapidly produced a misidentification of the population (Gold, 1967).

Johnson's (1967b) study was the only one employing rate that the author was able to locate. In this study she compared the arithmetic performances of 12 teacher-selected superior, average, and below-average pupils. Arithmetic performance was measured by rate correct, rate incorrect, and percent correct. The four teacher-selected superior pupils had the highest intelligence scores in the group (130 and above on SRA Primary Mental Abilities Test). The results indicated that two of the four had the highest median arithmetic rates correct. Three of the four had the lowest median rates incorrect (with the exception of one other child whose ability level was not indicated). The same three superior pupils had the highest median percent correct. Thus, the study indicated three out of four superior pupils' arithmetic performances are faster and better than average or below-average pupils.

To summarize: the author was able to locate only one article which reported rate data. Educational authorities indicate that rate is an important measure. This study uses rate to measure performance differences between gifted and regular children across a range of behaviors.

RATE AS THE MEASURE

Rate as a basic datum has been used since the first half of the century (Skinner, 1938). It is one of the most sensitive measuring procedures used to quantify behavioral phenomena. Sensitivity is characterized by the rapid, efficient, and economical differentiation between variables; rate has sensitivity as its cornerstone (Lindsley, 1964).

All precise educators use some type of measuring device to assay their particular area. The natural sciences have predicated their measurement on time and space dimensions (Hanson, 1958; Lindsley, 1966b). It is by combining precise, functional dimension points of time and space that man is able to bring order out of seeming chaos.

This marks the potential contribution of rate in precision teaching.

It is incomplete simply to know, note, or mark that a given event has occurred - nor is it sufficient to record its force, amplitude, latency, or duration. These behavioral parameters are limited in precision of recording and frequently are more indicative of the observer's decisions than of the subject's behavior (Skinner, 1961). In addition, traditional behavior measures of force, amplitude, duration, or latency are not directly relevant to the majority of educational problems. Education is not concerned with amount of force a child uses in a temper tantrum but rather his rate of outbursts.

Skinner (1966) notes five germane points about rate of responding as a datum. First of all, rate of responding is important because it is especially relevant to the principal task of a scientific analysis. The drama of behavior should not obscure the search for *why*; the "*whys*" become clear when rate records are kept. The second point declares that rate of responding is an important step in the direction of prediction and control of behavior - which calls for an evaluation of the probability that a response will be emitted.

The third point is of particular relevance to education:

> Rate of responding is one of those aspects of a subject matter which do not attract attention for their own sake and which undergo intensive study only when their usefulness as a dependent variable has been discovered. Other sciences have passed through comparable stages . . . the mere weight of a given quantity of a substance is of little interest in its own right. Yet it was only when the weights of substances entering into reactions were found to obey certain laws that chemistry moved into its modern phase. Combining weight became important because of what could be done with it. Rate of responding has emerged as a basic datum in a science of behavior for similar reasons (p. 16).

The fourth point Skinner makes, "rate of responding differs from the measures derived from earlier devices . . . such as the time required to complete a task or the effort expended or the number of errors made in doing so (p. 16)," has direct implications for education. Teachers vary in their criterion of what the "effort is for a given task" or the precise definition of an error. Rate puts the responsibility of behavior where it belongs: with the child.

This is related to the fifth point, which suggests that "changes in rate of responding are directly observed, they have dimensions appropriate to a scientific formulation, and under skillful experimental control they show the uniformity expected of biological processes in general (p. 17)."

In another article, Skinner (1961) points out that our measures must have relevant and comparable properties. The dimensions of the change must spring from the behavior itself; they must not be imposed by an external judgment of success or failure, or an external criterion of completeness.

The article by Skinner entitled "*The Science of Learning and the Art of Teaching*" (1961) emphasizes the role of education. "Education is perhaps the most important branch of scientific technology. It deeply affects the lives of all of us. We can no longer allow the exigencies of a practical situation to suppress the tremendous improvements which are within reach. The practical situation must be changed (p. 152)."

Whelan and Haring (1966) appear to be responding to the need to change the current situation. They maintain that "behavioral responses can be measured and analyzed quantitatively. Precise, observable measurements are directly related to the application of appropriate behavior modification techniques. Behavior can be observed; postulating unobservable causes that attempt to explain behavior leaves educators with esoteric concepts which cannot be arranged or manipulated in classrooms designed to modify behavior (p. 287)."

In this discussion of motivation, Whelan and Haring mention the use of rate as an indicator. "High rates of responding in problem solving situations, such as in working arithmetic problems, because such responses have accelerating consequences, is in reality what many label motivation when they view the occurrence of that behavior. When one states that a child is motivated, what is really being observed is a child who is responding under the control of environmental consequences (p. 287)."

Thus, the measure of rate provides information as to what motivates a child, and what his consequences are (Haughton, 1967b).

In addition, rate provides an objective, reliable means of evaluating teacher effectiveness (Johnson, 1967a). Through the use of performance rates, Johnson successfully demonstrated the effects of a student teacher in a class of six primary, learning-disabled children. The performance rates of 50 percent of the children accelerated when the student teacher had responsibility for the class.

Caldwell (1967) used rate as the measure of pupils' behavior to assess the effectiveness of a student-teacher training procedure (telecoaching). In another study, Caldwell (1966) demonstrated pupil performance rates to be more sensitive than percent. He suggests that (1) percent is not a direct record of pupil behavior, (2) percent is, rather, a summary statement, since it transforms information into 100 units, and (3) percent has a scale ceiling.

Holzschuh (1967) found rate correct more sensitive than percent correct in a regular classroom situation. This sensitivity was most pronounced (forty to one) at the probability level of 10^{-4} ($p=.00, 01$).

As with any new application of a demonstrated technique, doubts and questions occur. Suggestions can be made and data presented which substantiate the efficacy of rate. However, "the proof of the pudding is in the eating (Cervantes, c. 1600)."

METHOD

CHILDREN

The author obtained behavior rates from 46 gifted and 30 regular children in grades four, five, and six. Table 1 separates the distribution of pupils by grades.

TABLE 1

Pupils in Grades and Categories

Categories	Grades			Total
	4	5	6	
IQ 130 or above	9	13	24	46
Regular	10	10	10	30
Total	19	23	34	76

Table 1. Frequency breakdown for gifted (IQ score 130 or above) and regular pupils in grades four, five, and six.

Two schools from a large metropolitan area contributed to this study: 19 gifted pupils participated from accelerated special clases in a suburban school; 27 gifted pupils participated from a private urban school for young men.

Each teacher selected the children in her class whom she considered gifted, and then defined what the term meant to her. The author selected pupils with intelligence-test scores of 130 or above (41 boys and five girls) from this group. A comparison group of 30 regular children (18 boys and 12 girls) was randomly selected from other classrooms in the suburban school. No pupils had auditory, motor, or uncorrected visual deficits.

The school records provided California Test of Mental Maturity scores for all children. For the regular pupils, scores ranged from 93 to 120, with a median of 110. For the gifted, scores ranged from 130 to 166 with a median of 138.

BEHAVIORS

The five behaviors whose rates were measured included tapping, walking, reading, answering, and calculating. The child tapped the table 100 times with his index finger. He then walked in place for 100 times; each foot touching the ground counted as one. The child then read aloud two paragraphs from the eighth-grade level of the *Diagnostic*

Reading Scales (Spache, 1963). Reading rate correct was computed by dividing total words correct by total time required. For the answer rate, the child responded to a question for one minute. The number of words he spoke was tallied. For calculation rate correct, the child worked a page of arithmetic problems from the *Wide Range Achievement Test* (Jastak and Jastak, 1965). The number of successful operations required to complete each problem, per unit of time, determined the calculation rate correct.

Rate or rate correct served as the measure for each behavior; that is, number of responses divided by time. In four of the rates (tap, walk, read, and calculate), number was held constant and time varied. For the answer rate, time (one minute) was held constant and number varied.

School records provided the pupils' scores on the *Stanford Achievement Test* (1953). Selected scores included: total battery median, arithmetic computation section, word meaning section for grades four and five, and paragraph meaning section for grade six. Since the pupils were in three different grades, a direct comparison of scores would be unfair to the younger pupils, who possibly had minimal exposure to the test material. Thus the author computed a difference score, based on grade level, for each pupil. In other words, if the pupil took the test in the eighth month of his fourth school year and obtained a total battery-median score of six years and two months, a difference score of one year and four months (based on the achievement test's 10-month year) would result. Achievement comparisons were made on the basis of these difference scores.

EQUIPMENT AND SETTING

The only equipment required for the rate sample was paper, pencil, stopwatch, and wrist counter (Lindsley, 1966a). Any available room in the school served as the setting. Each child was seen individually for the duration of the sampling. Median time required to complete sampling of four behaviors (tap, walk, read, answer) was 11 minutes. Median time required to complete the calculation sample was 10 minutes.

RESEARCH

In general, the results of this study show that: (1) gifted pupils' performance rates *overlap* with those of regular children; (2) on the average, gifted pupils perform significantly faster than regular pupils on both academic and non-academic behaviors; (3) significant differences exist between the grades; and (4) correlations between the academic rates and achievement scores, non-academic rates, and intelligence-test scores are all beyond the .005 level of significance.

RATE OVERLAP

DESCRIPTION

As graphically demonstrated in Figure 1, rate distributions of regular (R) and gifted (G) children overlapped. The vertical axis, a six-cycle logarithmic scale, represents movements per minute (rate). The logarithmic scale allows calculation rate correct and tapping to appear on the same graph without distorting the proportional differences between the two behaviors. In other words, on a logarithmic scale, the distance from one to two calculating operations correct per minute is as important as the distance from 100 to 200 taps per minutes. An arithmetic scale would graphically compress these differences. All children tapped much faster than they calculated; calculation rate correct was the slowest behavior sampled. Similarities existed in the upper limit of the reading and answering ranges; however, both gifted and regular child-

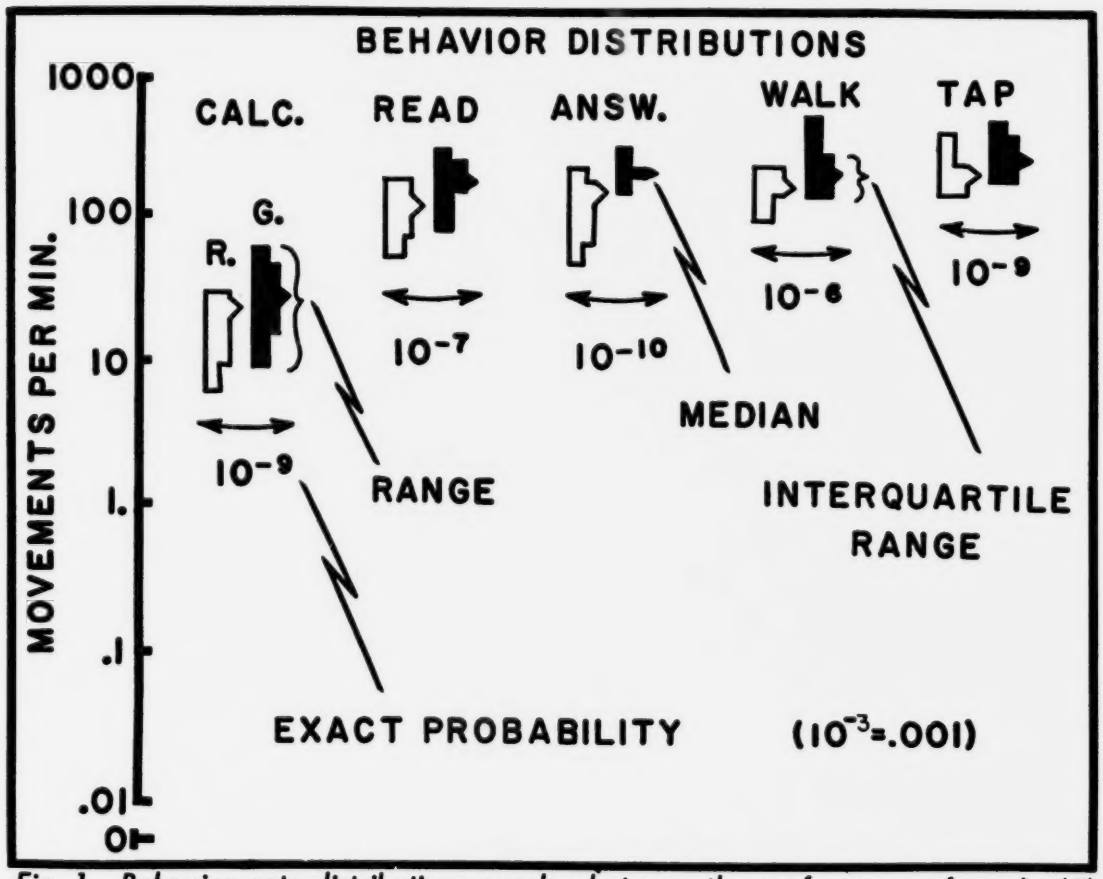

Fig. 1. Behavior-rate distributions overlap between the performance of regular (R) and gifted (G) pupils plotted on a six-cycle, logarithmic scale. The exact probability levels indicated gifted performed significantly faster than regular pupils on all behaviors.

ren answered (medians) faster than they read (medians). Median rates of gifted children on all five behaviors were faster than those of regular pupils.

STATISTICAL ANALYSIS

Percentages of rate overlap between gifted and regular pupils' behavior distributions included: tapping, 20 percent; walking, 24 percent; reading, 16 percent; answering, 20 percent; and calculating, 24 percent.

DISCUSSION

According to the distributions of behavior rates, giftedness appears to be on a continuum - with some gifted clearly performing faster than regular children. However, there were some individuals labeled gifted who performed at rates similar to those of regular pupils. Figure 2 gives an example of specific rates for two gifted and two regular pupils. David (high-rate gifted) and Mark (low-rate gifted) calculated, answered, and read faster than Jim (high-rate regular) and Joe (low-rate regular). Jim tapped faster than Mark but they both walked at the same rate. Thus, taken as a group or by selected individuals, behavior rates of gifted overlapped those of regular pupils.

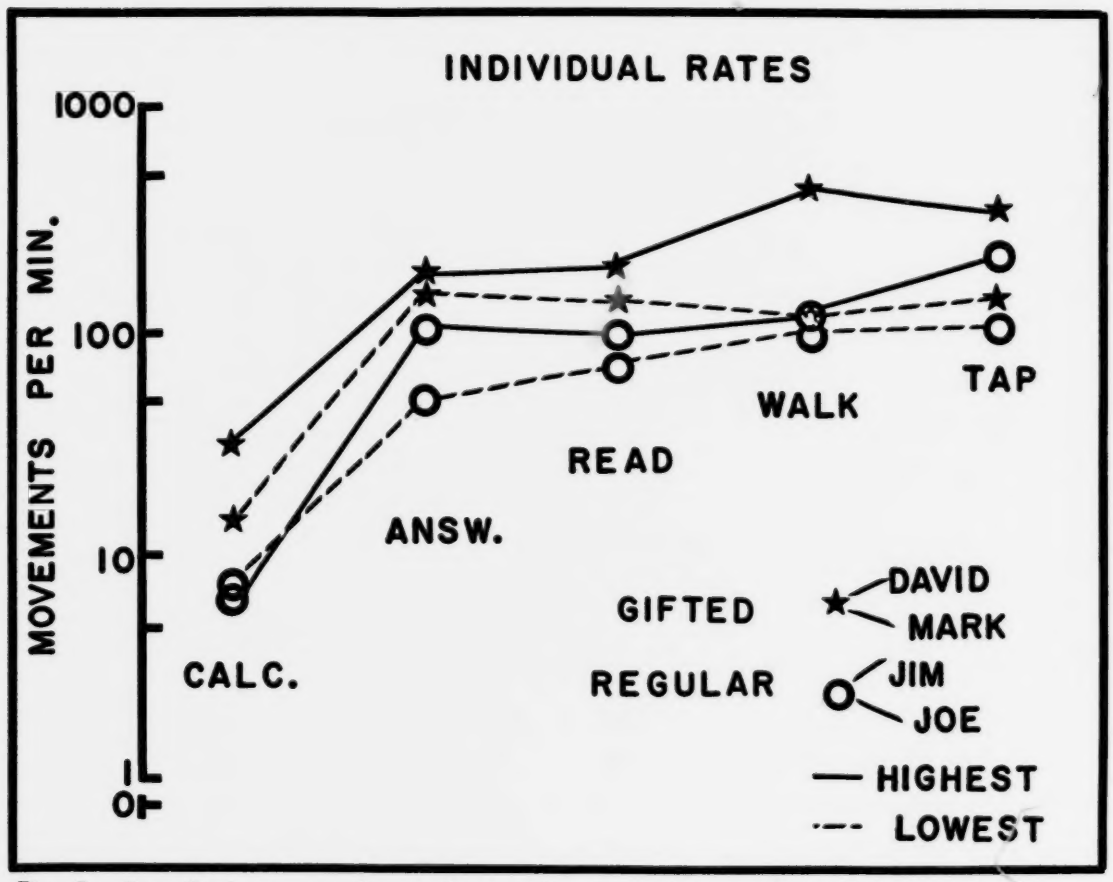

Fig. 2. Specific rate overlap indicated for two of four selected pupils. The slowest rate sampled was calculation rate correct for all four pupils.

GIFTED PERFORMED FASTER

DESCRIPTION

Figure 3 specifies performance-rate comparisons between gifted and regular pupils for each grade. The vertical axis represents the difference between gifted and regular pupils' median rates for the same grade and behavior. For example, sixth-grade (octagon) gifted pupils cal-

culated correctly (multiplication sign) at 28.4 operations per minute, while sixth-grade regular pupils calculated correctly at 17.5 operations per minute. The difference between the two medians (plotted on the vertical axis) was 10.9 (octagon and multiplication sign). The exact probability level (Lindsley Mid-Median Test, 1966c) of this difference ($p=.00,000,05$) is located on the horizontal axis; this was the most highly significant difference. Each behavior was compared on each grade level. Highest median differences occurred in tapping, while second highest median differences were in reading. In other words, gifted in grades four, five, and six tapped and read faster than regular pupils.

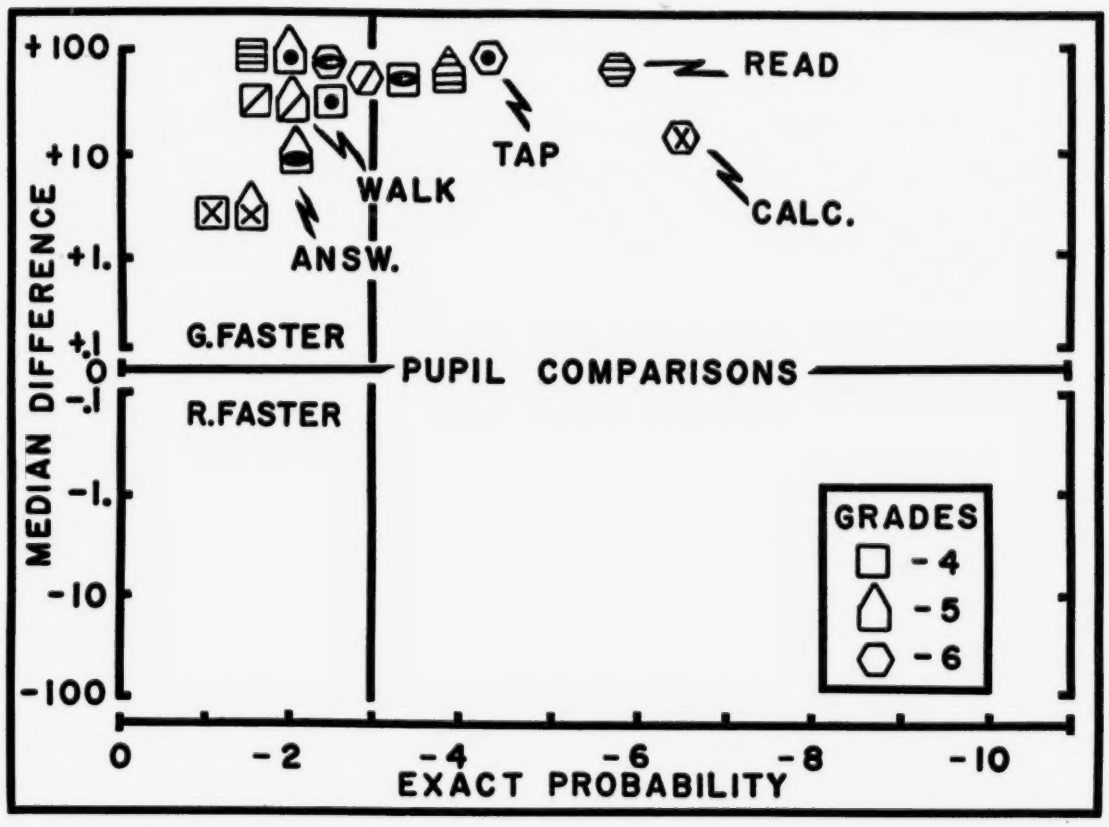

Fig. 3. Differences between the median rates indicated gifted performed faster than regular pupils in all three grades. The three most significant differences between gifted and regular pupils were sixth-grade tapping, reading, and calculating.

STATISTICAL ANALYSIS

The Lindsley Mid-Median Test was used to determine exact probability levels of the differences between gifted and regular pupils. Across the three grades for each group (Figure 1), significant differences between all gifted and all regular pupils ranged from

10^{-6} ($p=.00,000,4$) to

10^{-10} ($p=.00,000,000,06$).

That is, the results only could have occurred by chance alone four out of one million times to six out of 10 billion times. As a criterion for discussion, the change (probability) level of one out of one thousand times ($p=.001$ or 10^{-3}) is used for Figure 3. The results of the Mid-Median Test indicated that sixth-grade gifted tapped, read, and calculated faster than sixth-grade regular pupils. Fifth-grade gifted read faster than fifth-grade regular pupils, while

fourth-grade gifted answered faster than fourth-grade regular pupils. To double check these results, a more parametric statistical analysis was employed. The analyses of variance (single classification) on the five rate measures showed differences between gifted and regular pupils to be beyond the .01 level of significance.

DISCUSSION

On the average, gifted performed faster than regular children (Figure 1). The faster rates occurred on all behaviors, and not solely on those directly related to academic tasks. The only behavior which was not significantly different (beyond the .001 criterion of significance) for any grade level was walking (Figure 3). By the fourth grade, some gifted are performing faster than regular children. It would be interesting to determine the age at which rate differences between children begin to occur. There are no technical problems involved in recording performance rates during a child's earliest months (Lindsley, 1964).

GRADE-LEVEL DIFFERENCES

DESCRIPTION

It would be interesting to determine if older or younger gifted perform faster on more behaviors than do regular pupils in corresponding grades. In other words, do differences between gifted and regular pupils *increase* with grade level? Figure 4 schematically illustrates that the gifted differed more from regular pupils as grade level increased. In the sixth grade, comparisons between gifted and regular pupils on all five rates were significant beyond the .01 level (100 percent); whereas, in the fourth grade, only two of the rate comparisons were significant (40 percent). The .01 level of significance was selected for discussion here because it indicates the most marked differences.

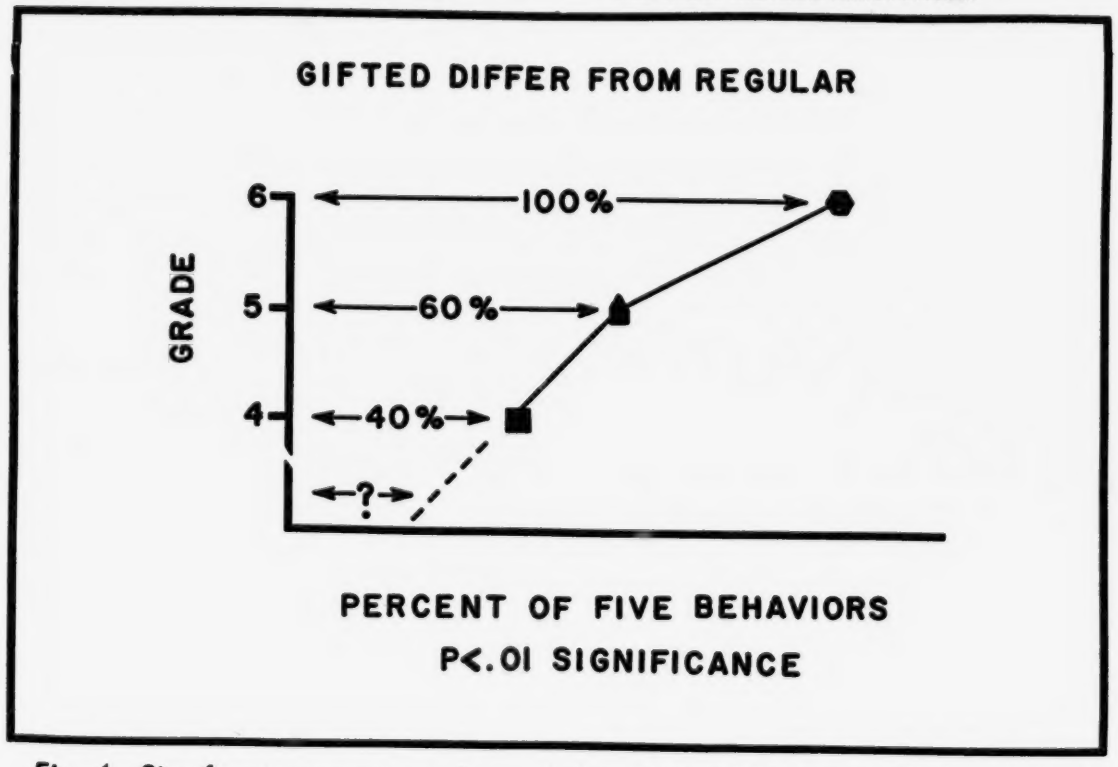

Fig. 4. Significant comparisons beyond the .01 level between gifted and regular pupils most marked in the sixth grade (100 percent).

How do performance rates of gifted children compare among themselves? Looking at only the gifted, differences associated with grade level are graphically illustrated in Figure 5. The outside symbol (square, pentagon, or octagon) represents the grade with the higher median rate which surrounds the grade with the lower median rate. Both grade-level indicators enclose the symbol for the particular behavior. Where the upper grade's median rate was faster than that of the lower grade, the symbols appear on the plus (+) portion of the figure (vertical axis). Where the lower grade's median rate was faster than that of the upper grade, the symbols appear on the minus (−) portion. The same descriptive system presents comparisons among grades for regular pupils alone (Figure 6).

STATISTICAL ANALYSIS

Using the Lindsley Mid-Median Test, four between-grade comparisons of gifted children were significant beyond the 10^{-3} level (Figure 5). Sixth graders read faster than fourth graders, and calculated faster than fourth and fifth graders. Fifth graders calculated faster than fourth graders. Using the same analysis and criterion level, differences between grades for the regular children were not as pronounced (Figure 6). Only two comparisons were significant: fifth and sixth graders calculated faster than fourth graders.

DISCUSSION

What factors are related to rate differences across grade levels? There were no significant differences due to sex, so that alternative can be eliminated. Are such differences associated with grade level (Figure 4)? Or are they related to the "gittedness" of these pupils (Figure 5)? In other words, do sixth-grade gifted perform faster because they are "gifted" - or because the are older? By comparing each gifted grade as well as each regular grade with the other two (*e.g.*, fourth with fifth and fourth with sixth), there are 10 comparisons (five behaviors times two grades). If the differences were related to the children getting older, then both gifted and regular sixth graders would have more significant comparisons. If the differences were associated with the "giftedness" or "non-giftedness" of these pupils, the number of significant comparisons across grade levels should remain the same. If these differences were related to some combination of these two factors, then older gifted would have more significant comparisons than younger gifted pupils. For these data, using the criterion of a significance level beyond .01, the older gifted had more significant comparisons than did any other group. Figure 7 indicates that 60 percent of the comparisons were significant beyond the .01 level for the sixth-grade gifted pupils. For the regular sixth graders, only 20 percent of the comparisons were significant.

The finding that sixth-grade gifted had more significant comparisons than any other group could be partially a function of those behaviors selected for the rate sample. Calculation and reading are academic skills acquired only with behavioral output and time. Increased performance rates of gifted may have contributed to their faster and more correct reading and calculating. The gifted sixth graders may have had more opportunity to acquire these skills.

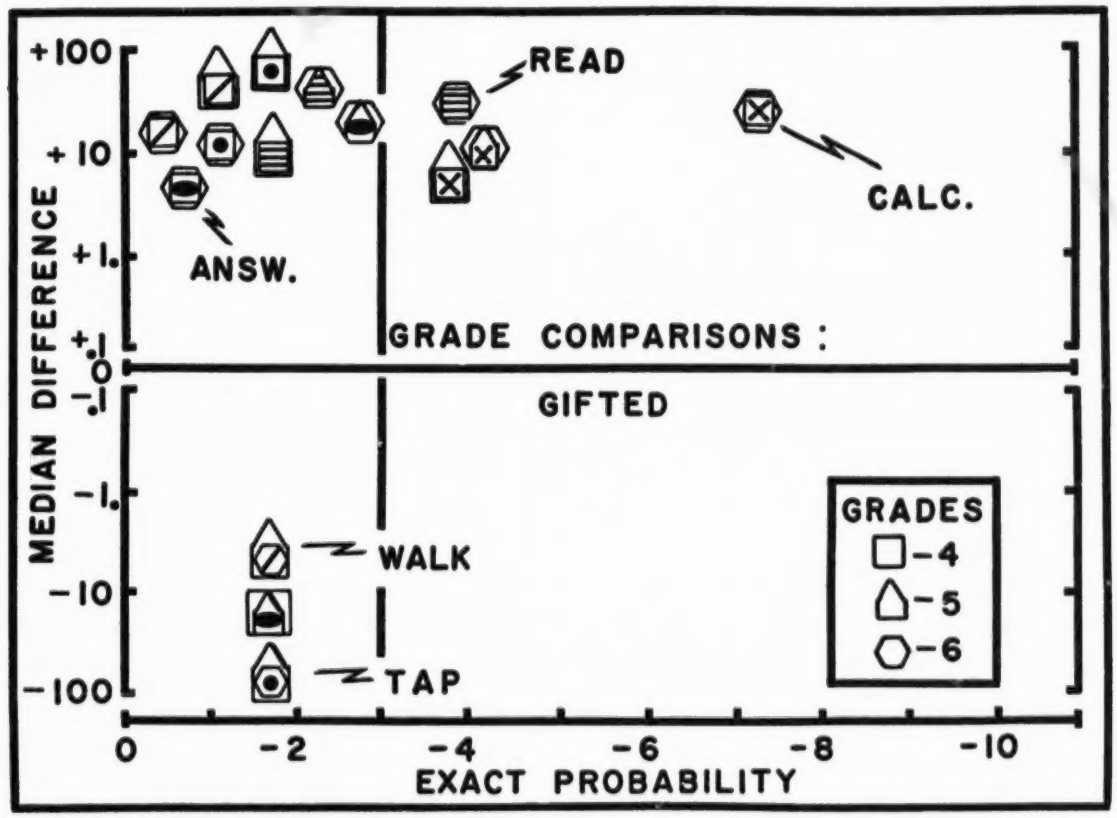

Fig. 5. Within the gifted group, sixth graders performed faster than fourth graders on all five behaviors. The most significant differences between fourth and sixth graders were in reading and calculating rate correct.

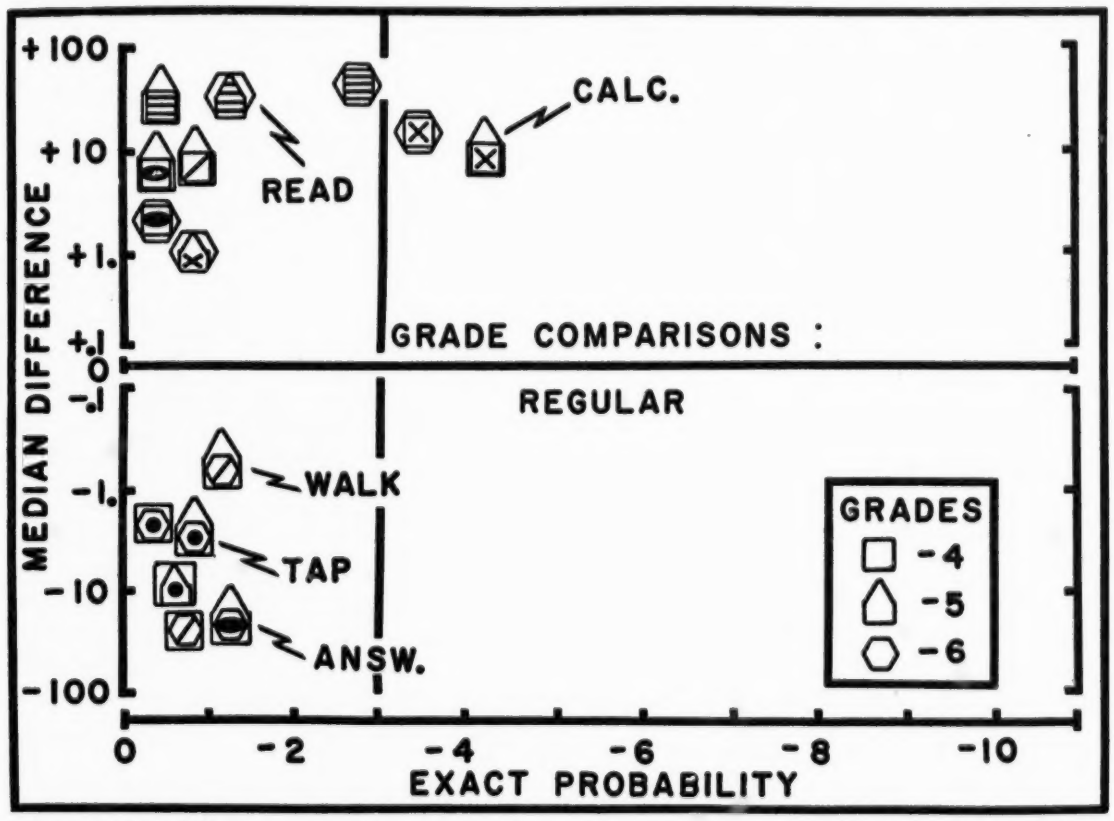

Fig. 6. The differences within the regular group were not as marked as those within the gifted group. For regular pupils, the behavior most significantly different was calculation rate correct.

Substantiating evidence for grade-level differences could be determined by following selected children from preschool through the grades with spot checks on a rate sample. Continuous rate records on the individual pupil could detect some of the factors contributing to this increase. For example, if David has access to more words over a year's time, then it also stands to reason that he has access to an abundance of other stimuli and consequences which could accelerate his behavior.

pupils. Table 2 presents the mean difference scores for the achievement test. Significant differences (F ratios, $p < .01$) occurred between gifted and regular pupils on all three achievement-test scores (total battery median, word or paragraph meaning, and arithmetic).

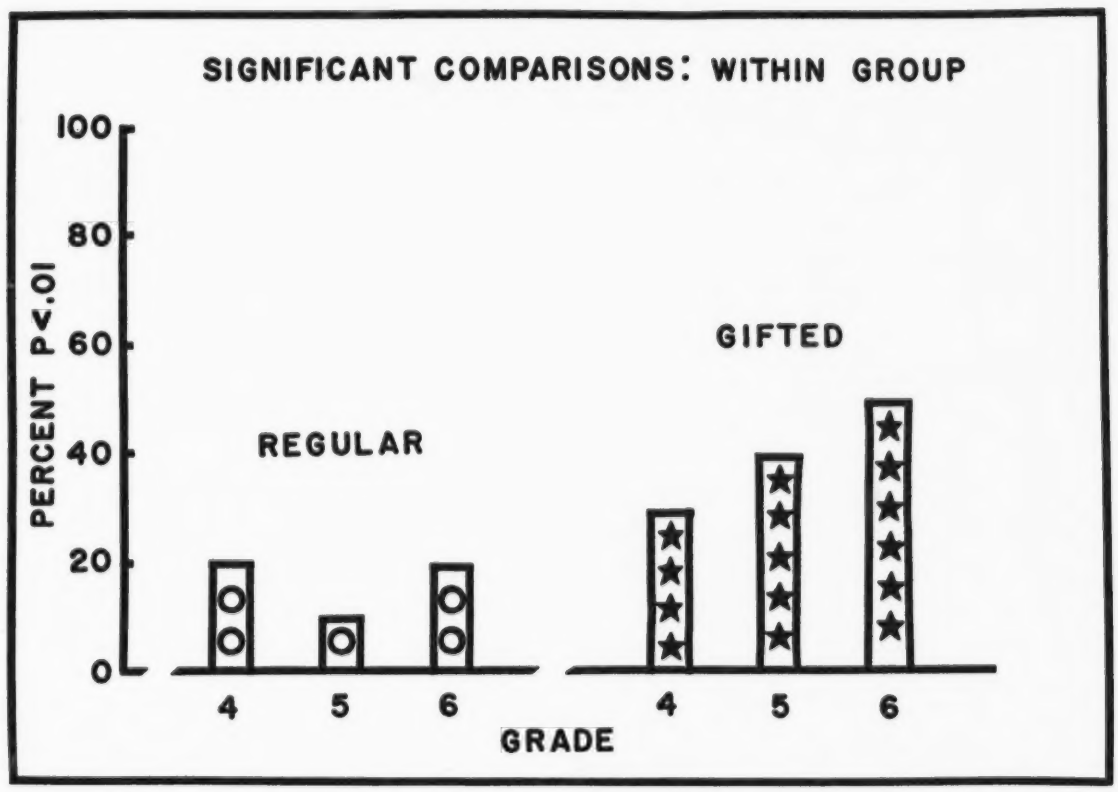

Fig. 7. Sixth-grade gifted had more significant comparisons than any other group.

ACHIEVEMENT-TEST SCORES

DESCRIPTION

Teachers can usually detect some gifted children by their superior academic performance. Thus, gifted may be expected to perform significantly better on achievement tests than regular

STATISTICAL ANALYSIS

Gifted performed significantly better than did regular pupils on all achievement-test measures. However, in the light of the grade differences discussed in the preceding section, where do these differences come from? The Studentized Range Method (Tukey, 1949) allows a separation of sub-groups to determine locations of significant differences in more detail.

For total battery median, mean scores of all gifted (both schools and all three grades) differed significantly from mean

TABLE 2

Mean Achievement Test Scores

Grade	Score	Mean Difference Score	
		Gifted	Regular
6th	Total Battery Median	4.42	0.10
5th	" " "	3.57	0.17
4th	" " "	2.78	0.24
6th	Word or Paragraph Meaning	4.54	0.54
5th	" " " "	3.16	0.81
4th	" " " "	2.58	0.05
6th	Arithmetic	3.95	0.38
5th	"	1.47	1.27
4th	"	1.05	0.17

Table 2. Gifted pupils' mean difference scores on the STANFORD ACHIEVEMENT TEST were all higher than those of regular pupils. The differences were most marked in the sixth grade.

scores of all three grades of regular pupils. Within the gifted sub-groups, fourth graders from both schools and fifth graders from Pem-Day differed significantly from sixth graders in both schools.

On the reading section, mean scores of all gifted sub-groups differed significantly from those of regular grades. For the gifted alone, Pem-Day fourth and fifth graders differed significantly from all sixth graders, and from Antioch fourth and fifth graders.

Differences in mean arithmetic scores were not as widespread. Only Antioch gifted fifth graders and both schools' gifted sixth graders differed significantly from the other sub-groups.

DISCUSSION

Concerning these results, four possible speculations can be offered: (1) children who are gifted do better because "it is their nature;" (2) gifted children respond better to testing procedures; (3) these particular gifted children have had effective teachers and training; or (4) increased rate of behavior produces access to more consequences and acquisition of more

materials. Only the last three can be tested by relating their values to achievement test performance. The last will be the easiest to measure for such a relationship.

CORRELATIONS BETWEEN RATE BEHAVIORS

DESCRIPTION

Figure 8 presents the correlations (Pearson Product-Moment Coefficient of Correlation) between all five rates. Tapping and walking were the most highly correlated at $r=.80$ (horizontal axis). The probability that this correlation could have occurred other than by chance is less than 10^{-7} ($p<.00,000,01$ on the vertical axis). Other correlations at the same level of probability (but less in amount) were reading with calculating ($r=.66$) and reading with answering ($r=.50$).

STATISTICAL ANALYSIS

Pearson product-moment correlations were computed between each measure and all others. Table 3 presents all the correlations - some of which will be discussed in subsequent sections. All correlations were significant beyond the .005 level. Converting correlation values (r) to t scores determined the exact probability levels for each correlation.

DISCUSSION

All rates were significantly correlated. Tapping, in general, was most highly correlated with the other four behaviors. Answering was least highly correlated with the other four. The one major exception was the higher correlation between reading rate correct and answering.

The data suggest that reading skills may be predicted from answering skills, and vice versa; however, one must be cautious about inferring causation from simple correlation. One method of determining the extent of this relationship would be to select a child having low reading and answering rates and increase his rate of reading. His rate of answering could then be measured to detect any subsequent increase which may have been caused by accelerating his reading rate.

CORRELATIONS BETWEEN RATES AND ACHIEVEMENT SCORES

DESCRIPTION

Is the rate sample related to more traditional types of assays given to children? Correlations between behavior rates and achievement-test scores are presented in Figure 9. Answering rates and scores from the achievement test's arithmetic section showed least correlation in magnitude and significance. Highest correlation and probability occurred in the case of reading rate correct and the achievement test's total battery median. As one might expect, reading rate correct and scores from the achievement test's reading section were highly and significantly correlated ($r=.75$ at 10^{-7}). Calculation rate correct and the achievement test's arithmetic section scores were also highly and significantly correlated ($r=.72$ at 10^{-7}).

DISCUSSION

One finding (other than the expected high correlations for the academic measures) which may not have been predicted, was the correlation between total battery-median scores (from the

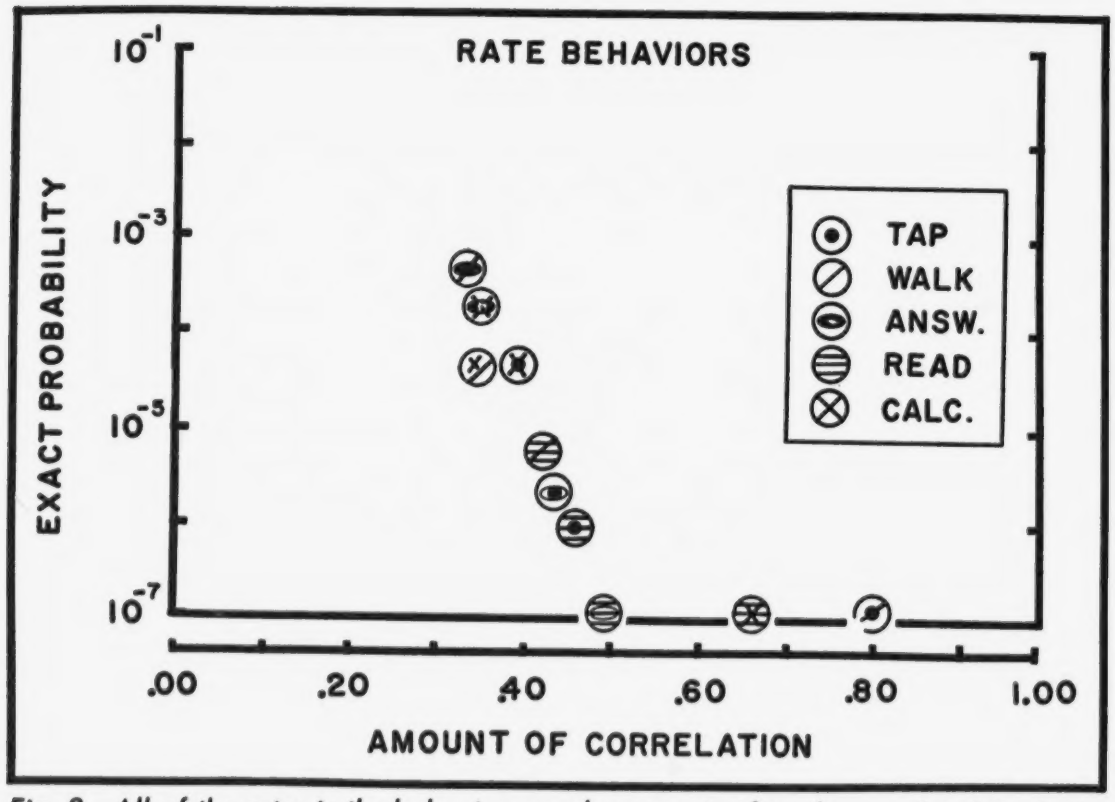

Fig. 8. All of the rates in the behavior sample were significantly correlated for both gifted and regular pupils. The highest and most significant correlation was between tapping and walking.

TABLE 3

Correlations* of Variables with Gifted and Regular Children

Compared	Measures							
	Walk	Answer	Read	Calculate	Tot. Md.	Read	Arith.	IQ
Tap	.80	.42	.44	.37	.47	.43	.36	.40
Walk		.32	.41	.37	.45	.43	.36	.41
Answ.			.50	.33	.46	.47	.32	.40
Read.				.66	.79	.75	.58	.65
Calc.					.63	.56	.72	.53
Tot. Md.						.91	.75	.82
Read							.63	.76
Arith.								.61

* Pearson Product-Moment Correlation, all significant $p < .005$

Table 3. Pearson product-moment correlations for the five behavioral rates, three achievement-test scores, and the intelligence-test scores were all significant beyond the .005 level.

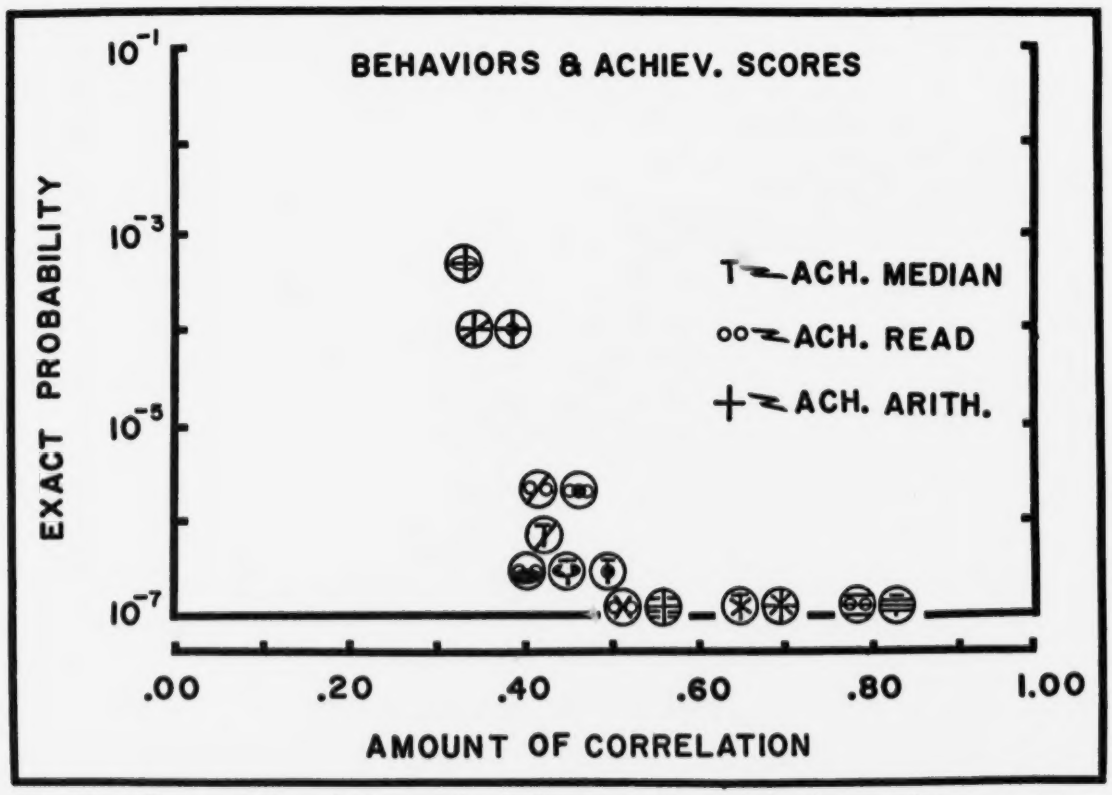

Fig. 9. All correlations between the behavior rates and the three achievement-test scores were significant. The academically related performances were the highest in correlation and most significant.

achievement test) and tapping rate. Could tapping rate be used to predict pupils' academic performance? The amount of time saved (plus the expense of administering tests for group placement) could be considerable. It may be that the rate sample could be utilized in the school system as a convenient, economical, and efficient screening technique. Children thus detected could then be more extensively followed with continuous rate records, for more adequate and reliable curricular and classroom placement. At any rate it makes for interesting speculation.

CORRELATIONS BETWEEN IQ, RATES, AND ACHIEVEMENT SCORES

DESCRIPTION

Figure 10 illustrates the correlations across intelligence-test scores, behavior rates, and achievement-test scores. All correlations are markedly significant ($p < .00,001$). The most highly significant and highly correlated relationship occurred between intelligence-test scores and scores from the achievement test's total battery medians. This indicates that intelligence tests of the kind used in this study and achievement tests may be sampling similar behaviors. Thus, it is not too suprising that tapping was the behavior least correlated with intelligence-test scores. Even walking, which did not fare as well in previous sections, was more highly correlated than tapping. The most highly correlated and significant measures were those related to academic skills (*e.g.*, reading rate correct, calculating, and so forth).

DISCUSSION

Intelligence tests tell us about pupils' test-taking behavior. According to data presented in Figure 10, the majority

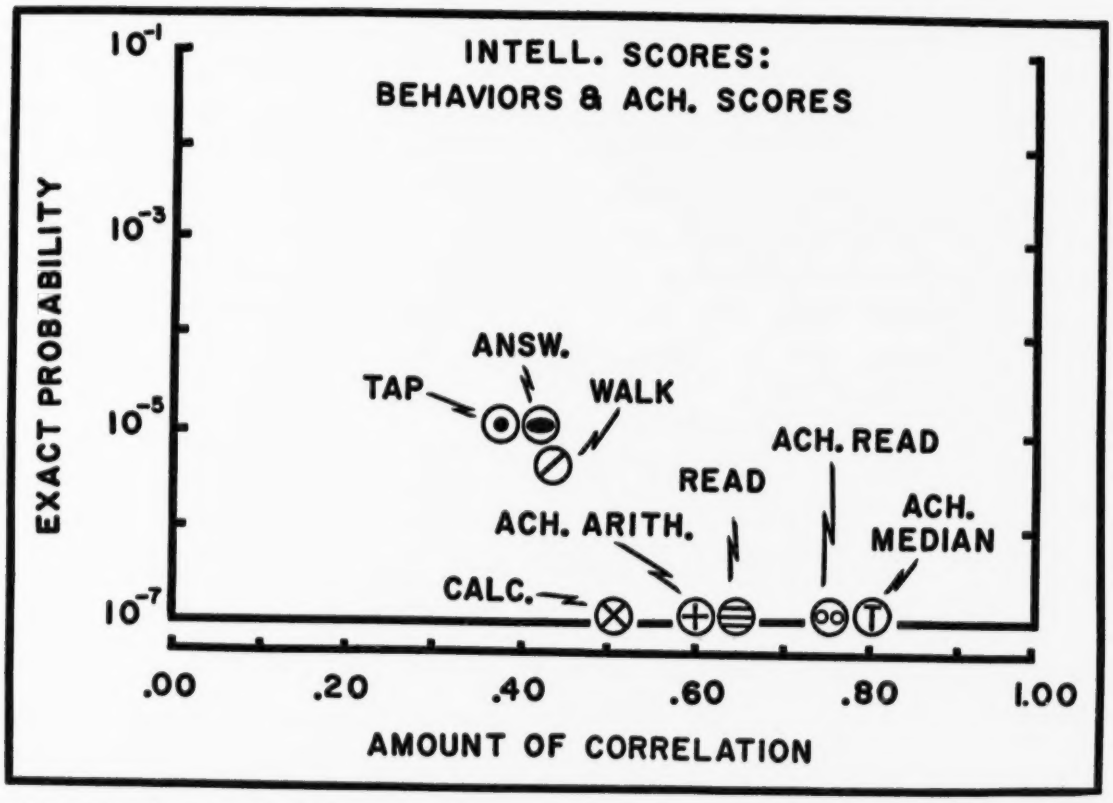

Fig. 10. The intelligence-test scores were most significantly and highly correlated with the academically related performances.

of the test questions are similar to academically related tasks, which in turn are measured by achievement test. This study suggests that a sample of behavior rates may contribute new information, heretofore untested, on individual children. Rate records provide teachers, and educators in general, with an entirely new source of information. By combining rate measures with other types of assay (Haughton, 1967b), the teacher may be better equipped to teach and the child better enabled to learn.

SUMMARY

From this study, eight possible conclusions may be drawn. The rate sample showed: (1) Behavior rates of gifted and regular pupils overlapped (Figure 1). (2) On the average, rates of gifted were significantly faster than regular pupils (Figures 1 and 3). (3) The sample successfully discriminated gifted from regular pupils (Figures 2 and 3) as well as grade levels (Figures 5 and 6). (4) The differences between gifted and regular pupils increased with grade level, but not as a function of grade level (Figures 4 and 7).

Achievement-test scores showed: (5) Gifted performed significantly higher than regular pupils. (6) The sixth-grade gifted pupils did better on all three achievement scores, and were significantly different from the regular pupils (Table 2).

Correlations between measures indicated: (7) The highest and most significant correlations were intelligence-test scores with total battery-median scores and tapping with walking (Figures 10 and 8). (8) All correlations were beyond the .005 level of significance (Figures 8, 9, and 10), indicating there was a relationship between each measure examined in this study (Table 3). Therefore, it is meaningful to talk about fast and slow people - they exist.

The major demonstration of this study is that rate is a sensitive, accurate measure which can differentiate between individual children as well as groups such as gifted and regular pupils. Furthermore, the differences between these children increase as the children get older. Hence, it appears vital that intermittent rate samples as well as continuous rate records be kept for each child. When the records indicate there is a deceleration in rate, appropriate steps may be taken by the child, his teacher, and parents before academic retardation becomes pervasive and difficult to remedy.

Since these data were not taken directly from the classroom, one must be cautious about extrapolating to classroom behavior rates. By using discrete rate measures, this study suffers from the inadequacies of all "one-shot" measurements. However, further exploration is definitely indicated. For example, one way of determining how much of the variance in the data is due to a child's giftedness would be to take a non-gifted child (by some definition, whether intelligence-test score, self opinion, teacher opinion, standardized achievement-test score or whatever) and accelerate his various behavior rates by means of contingent consequences and appropriate programming. Then, using standardized measuring devices, determine whether or not the child now fits into the appropriate category of giftedness.

If production of high rates leads to membership in the category of giftedness, then we as educators have a singular opportunity to provide the world with highly productive citizens. We no longer need to be content with simply honing the rough edges of behavior and imparting currently popular curricula. We may be in a position to produce giftedness.

Investigation of such a challenge would seem to be imperative.

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